Regenerative Design:
Toward the Re-Integration of Human Systems with Nature

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Introduction

Current practice in green design and building focuses primarily on minimizing damage to the environment and human health, and using resources more efficiently; in effect, just slowing down the degradation. A much more deeply integrated systems approach to the design and construction of buildings and human settlements (and nearly all other human activities) is needed if we are to reverse the degeneration of the earth's natural systems. The challenge is not just technological since it requires altering our assumptions, attitudes, and understanding to move from our current view of humans as standing apart from and using nature to being part of, participating in, and co-evolving with nature. The self-organizing, self-healing, and regenerative capability of natural systems is diminished by human-created systems designed from the dis-integrated viewpoint that we are outside of nature and thus free to act on it with only limited consequences or effects.

The apparent success of the industrial revolution is based, almost entirely, on our exploitation of the natural wealth (natural capital) that has accumulated over the several billion years that life has existed on Earth. To continue to thrive and evolve we need to redesign our systems to obey the laws of nature, including the laws of gravity, thermodynamics, biology, and ecology, to create systems that can co-evolve with and enhance the evolutionary capability of natural systems.

This requires a shift in thinking and in language. Most modern languages lack words to describe humans in relationship with nature. And most of the terminology of the "green" or "sustainable" building movement blurs rather than sharpens our understanding of the challenge we face. Terms like sustainability, high performance, and green are being more widely used. These recognize the limits of industrial approaches to satisfying human needs and have started to recognize the benefit of optimizing resources and systems. The next step requires that we begin working with natural systems on their own terms, not with a mindset still partially embedded in a dis-integrated world view. Thus the efforts to incorporate integrated design practices to achieve sustainable design objectives are only first crucial steps toward regenerating the degraded health of our planet. We use the term "regenerative," because it suggests the self organizing and self healing properties of living systems of which we are inextricably a part.

Building Capability Not Things

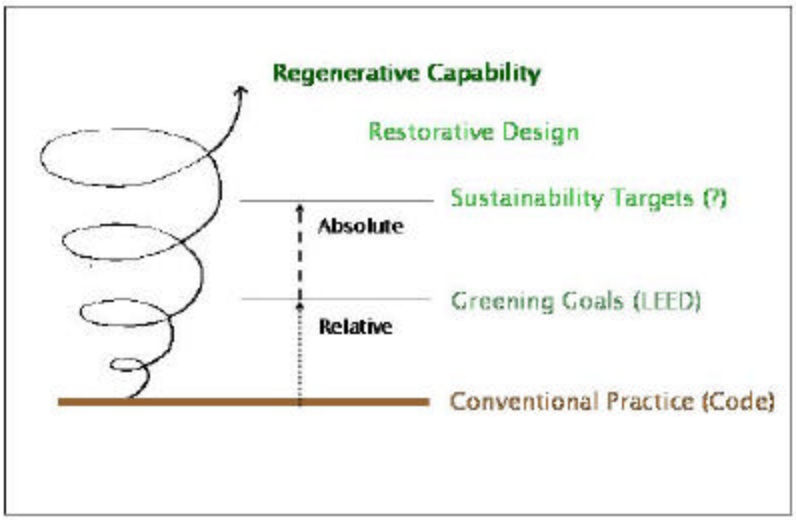

Figure 1

The above graphic illustrates likely thresholds the building industry (and society) will need to move through as we develop understanding of the integral relationship between human and natural systems.

The graphic builds on a diagram by Ray Cole illustrating the trend of rating systems based on the *relative* efficiency improvements in resource use to lead, logically to *absolutely no use* of scarce resources and problematic toxins (BREEAM, LEED, etc.). This raises the question, is the diminution of resource use sufficient to achieve sustainability? No one can say for certain – but likely not. Even if it was, the Factor 10 society proposed by some environmental scientists - a 90% reduction in western society's impact by 2050 – is not likely to be achieved if we continue our relationship to natural systems in the overly simplistic terms of impact reduction. This "limiting the damage" approach is based on the ingrained attitude that humans and natural system health are antithetical to each other. The conservation ethic – "let nature alone" – is a result of this view; an understandable first line of response considering the impacts of the last 500 years of human activity.

We are more likely to achieve large improvements if we *participate* with nature on its own terms. Even the consideration of "nature as a model" is a concept that prescribes a perceived boundary. Regenerative design requires that we *participate* with nature in a mutually beneficial relationship. This means instead of trying to *stabilize* natural systems by brute force and the creation of "manageable uniformity" (Lyle), we must identify the key systems (living and geologic) involved in a "place" and understand what permits these systems to maintain viability over time and allows them to evolve in relation to each other (a continuous birth, life, death cycle). In other words, long-term stabilization of both human and natural systems results from the seeming messiness of complex system diversity and an acknowledgment of slow change over time (an evolutionary construct).

> Focusing on technical solutions to make societal development independent of nature will not lead to sustainable solutions (Holling and Meffe 1996). Instead efforts

> should be made to tune and create synergies between economic development, technological change and the dynamic capacity of natural resource base to support societal and economic development.
> "Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations," Folke at al.

Natural systems are extremely effective at healing themselves. If we want to achieve health for the planet in the shortest amount of time the following two principles sum it up pretty well:
1) Natural systems have the self organizing capability to heal themselves – if we let them.
2) We are nature.

The practical implementation of these principles leads to place-based design. Place-based design not only uses resource efficiency as an approach but requires an awareness of what gives health to a place – using the smallest watershed as a basic unit. Inextricably, it requires humans to understand how they need to realign their activities in that place so that the systems (human and natural) have an opportunity to organize in self healing relationships. And this requires much more humility about our ability to "manage" natural systems by overriding the very real limits of natural systems and places.

Energy Flows, Self Organizing Natural Systems - Howard Odum
In order to shift to regenerative systems we need to understand the basis for regenerative processes in nature. Much of the foundational work that is critical to this redesign was done by Howard Odum, who provided the theoretical framework for understanding natural systems by proposing to use energy as the "currency" to study and quantify both man-made and natural systems, processes, and products.

One of Odum's greatest contributions is his use of the second law of thermodynamics to describe the viability of systems. The second law of thermodynamics states that, in a closed system, any physical process will result in the loss of some useful energy – some energy is always wasted. Since the first law of thermodynamics states that energy can be neither created nor destroyed, what the second law refers to as "wasted" energy is the degradation of the quality of the energy, a diminished ability for that energy to do work. The second law is often referred to as the law of entropy, the tendency for potential energy to degrade and diffuse, or the tendency for systems to move from order toward disorder. However, it is also possible for some amount of energy in a system to be upgraded to more concentrated forms as well, creating the extraordinary possibilities for life and order. This upgrading always results in a net degradation of energy in the whole system, however. On earth, the degradation of energy in the sun's thermonuclear processes provides the possibility for upgrading the quality of energy on earth and the creation of order instead of disorder.

Using the second law as a tool to measure what is happening in natural and human systems we can reveal how efficient and effective they are and make informed decisions about them. Odum's work aimed to clarify the importance of understanding not just the quantity of energy available or used, but the quality of that energy and the significance of the energy transactions. This led to his interest in embodied energy. He pointed out that complex work requires high-quality energy and the tendency to think of energy requirements just in terms of fuel ignores the range of other energy inputs including the energy embodied in materials, in human labor, and in the fuel itself. Recent research in the U.S., for example, demonstrates that the production of ethanol, a corn-based fuel additive promoted on the basis that it will help reduce U.S. dependence on foreign oil, actually requires more petroleum-based energy

to produce than it yields when burned. Odum similarly noted that taking the whole system into account, nuclear power actually uses or degrades more useable energy than it produces.

Our success in shifting to regenerative systems will be based in part on our ability to shift our systems to lower rather than higher energy systems. Odum wrote “We will find that the long term basis of our economy is ultimately the use of effective self-organizing solar converters: forest ecosystems, and lower-energy agricultural patterns that have long been with us.” (Odum, Energy Basis for Man and Nature, p. 9). When resources and sinks aren’t local, the costs of procurement and waste disposal become inordinately high. The broken nutrient cycle of current agricultural practice is a good example. Instead of returning nutrients to fields from which they come, we send our human waste via wastewater treatment to the rivers and oceans. This means huge investments of fertilizers are needed to replace the lost nutrients in the soil, while other investments are required to deal with the water issue. The whole system requires massive amounts of energy to transport everything.

A similar analysis of the materials and energy that go into buildings would reveal the same situation. The challenge as we deplete our non-renewable high-energy fuels, will be to shift to lower-energy, more local and more deeply integrated systems.

One way to get to lower-energy systems is suggested by John Lyle, in his book Regenerative Design for Sustainable Development. Lyle listed a number of general principles for design, starting with Let Nature Do the Work. Designing to take advantage of natural processes and flows typically results in systems that conserve resources, do less damage, and are less expensive to create and to operate. This demands place-based knowledge, understanding, and participation because nature doesn't work in the abstract, only in real places.

The Essentials

The first step toward regenerative design is to really understand ourselves as integral with nature. This means understanding our past relationship to nature and the potential of this relationship in the present and in the future. The western view of humans as distinct from nature must ultimately be changed for our species to survive. In reality humans have been actively influencing nature, positively and negatively, around the world for 30,000 years.

This shift doesn't give humans justification to destroy living systems, or undermine their capacity to thrive and evolve, or to abandon the protection and care for wild places. It might give us the justification to see ourselves as partners with other living systems, seeking the deeper roles and exciting possibilities of co-evolutionary relationships; relationships whose end results or outcomes are not controlled or predetermined by humans for strictly human ends.

We can manifest our relationship with nature in different ways. For example, we can compare Western society’s taxonomy for classifying living things as a very object-oriented system based on what things look like. In contrast, we can look at Aboriginal taxonomies whose classifications are based on a process-oriented approach, such as grouping plants based on what animals pollinate them.

We also must look at the degree to which we have been influenced by our understanding of Darwin's work. Out of an expectation that the world is a hostile place where scarcity and

competition are the common and constant realities against which we must all fight for survival, we have expected to find competitive systems and we have found them. But in reality, symbiotic relationships, the sharing of information and nutrients, the abundance of cooperative relationships in nature are vastly more prevalent. We haven't seen them because until relatively recently we weren't looking for them.

This translates into our language as well, as we have no word that summarizes the oneness of all things. In order to even communicate about this we have to bridge that gap by saying "human and natural systems" or "co-evolution." Some indigenous cultures have one word for the oneness of the variety of human and natural relationships because they have lived in those types of relationships.

There are other misconceptions that we will need to deal with, such as our notions about restoration. We have been attempting to 'manage' nature. As John Lyle put it, "Where nature has evolved to a level of infinite diversity, humans have chosen to design for readily managed uniformity." We attempt to stabilize systems and make them act in a uniform, predictable manner. Nature evolves, self organizes, and adapts. Stability in natural systems is a result of diversity of the relationships, more than diversity of the elements. An example from G.M. Day, "The Indian as an Ecological Factor in the Northeastern Forest, *Ecology* 34(1953) discusses American Indians and their inextricable relationship with pre colonial chestnut/oak forests in Eastern North America:

> For 5,000 to 10,000 years 80% of the eastern US forest was a Chestnut, Hickory, Hemlock, Oak forest (thick bark trees). If left unattended, this forest would have quickly evolved into a Beech Maple forest (thin bark trees). It didn't, because the native peoples were managing this ecosystem with frequent burnings of the detritus on the forest floor. This "managed" system was natural and it included human intervention; colonial settlers report being able to drive wagons through the forest as if it was a manicured park. It was this way until white man settled this area and moved these peoples out of this ecosystem – thus changing it to the forest system we have today.

We will need to overcome our tendency to generalize, meaning that the design of regenerative systems will always be place-based. Generalizing minimizes the ability for systems to reach their natural potential of self-regulation because each situation and location is unavoidably unique. This is why prescriptive solutions are inadequate. There is a corollary, which is almost the opposite of this. It is to seek optimum levels for multiple functions, rather than optimizing components in isolation, which generally tends to drive the system towards lower levels of diversity and performance.

Finally, it is important to conceptualize natural processes in terms appropriate to living systems and avoid the generalization of mechanical and cybernetic constructs. The terms "input-output," "cradle to cradle," "feedback loops," "ecological balance," and such, have led us to think about ecological issues in important new ways. However, these terms still identify us as a society and as a species separate from nature, acting to manage natural systems as though they are machines or businesses. Success, from the perspective of these terms, can only be gauged by looking at a myopic snapshot of what we, with hubris, consider the correct ecological construct. Instead, healthy ecological systems don't maintain a stasis; they have a spiraling, complex growth pattern that has continuous and changing birth/life/death cycles.

Living and natural systems are not merely closed loop systems, but continually evolving open systems. We can learn to co-evolve and co-create with them, and must do so if we are to create regenerative systems that will empower a more abundant future in which healthy human communities thrive.

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